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10/033,156	10/25/2001	James D. Beasom	125.020US01	7041

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Fogg Slifer & Polglaze P A
P O Box 581009
Minneapolis, MN 55428-1009

EXAMINER

MAGEE, THOMAS J

ART UNIT PAPER NUMBER

2811

DATE MAILED: 08/07/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/033,156

Applicant(s)

BEASOM, JAMES D.

Examiner

Thomas J. Magee

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 April 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections – 35 U.S.C. 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

2. Claims 1, 2, and 4 are rejected under 35 U.S.C. 102(e) as being anticipated by Nordstom et al. (US 2001/0012655 A1).

3. Regarding Claim 1, Nordstom et al. disclose a process for producing an integrated circuit comprising the steps of forming a nitride sealing layer (first layer) (25) (Figure 18) in a contact opening, wherein a second layer of nitride (44) (Figure 25a) is formed (page 13, [0137]) overlaying the first nitride layer and in contact (See Region 18 and 5,

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Figure 25a) with the first layer (34) (Figure 25a) to form a sealing layer, and further overlaying an exposed portion of the substrate and sidewalls of the opening. Using RIE (page 13, [0140]) without a mask, a portion of the second nitride layer is removed to expose the surface of the substrate without removing portions of the nitride covering the sidewalls (Figure 25b).

4. Regarding Claim 2, Nordstom et al. disclose (page 13, [0139]) that the nitride layer is deposited by LPCVD.

5. Regarding Claim 4, Nordstom et al. disclose (Figure 25b) that a portion of the first nitride layer (34) (under poly-Si 38) remains overlying the oxide after RIE is applied (See area near interface of Area 13).

Claim Rejections – 35 U.S.C. 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nordstom et al., as applied to Claim 1, and further in view of Wu (US 5,679,601).

Nordstom et al. do not disclose that the second nitride layer is formed by plasma enhan-

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ced chemical vapor deposition (PECVD). However, Wu discloses that PECVD (Col. 3, lines 66 – 67, Col.4, lines 1 – 5) is used to form the second sealing nitride layer (22) (Figure 6) and the layer etched by RIE to form sidewall spacers (Figure 7). Hence, it would have been obvious to one of ordinary skill in the art at the time of the invention to combine Wu and Nordstrom et al. to obtain a PECVD nitride layer of controlled density to reduce indiffusion of contaminants to the active device area.

8. Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nordstrom, as applied to Claim 1.

Nordstrom et al. disclose the use of RIE for etching the nitride layer, but do not disclose the times required to perform the task of removing the nitride overlaying the surface of the substrate without removing portions of the nitride layer overlaying portions of the sidewalls. It would have been obvious to one of ordinary skill in the art at the time of the invention to adjust the times of etch to avoid removing all of the layer from sidewalls. Since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimal or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

9. Claims 7 - 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nordstrom et al.

10. Regarding Claim 7, as discussed previously, Nordstrom et al. disclose a process for producing an integrated circuit where an oxide is formed on the surface of a substrate, wherein a first layer of nitride is formed overlaying the oxide in a contact opening formed

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in the integrated circuit. A second layer of nitride is deposited (page 13, [0137]) over the first nitride layer, further overlaying an exposed portion of the substrate and sidewalls of the opening (Figure 25a). Using RIE (page 13, [0140]) without a mask, a portion of the second nitride layer is removed to expose the surface of the substrate without removing portions of the nitride covering the sidewalls (Figure 25b) where the overlaying nitride layers seal the oxide (24, Figure 22, also shown after RIE in Figure 25b).

11. Regarding Claim 8, Nordstom et al. disclose (page 11, [0128]) that the contact openings through the nitride and oxide layers are done with a dry etch with one photoresist mask (Figure 21b).

12. Regarding Claim 9, Nordstom et al. disclose (page 8, [0105]) the formation of a thermally grown oxide layer.

13. Regarding Claim 10, Nordstom et al. disclose that functional devices within the integrated circuit are formed with a thermal oxide as the interfacial layer, but do not disclose that the oxide layer is "deposited." The formation of oxide layers by deposition is extremely well known in the art and commercial equipment readily available (for example, Applied Materials, Novellus, Lam Research and others). Therefore, it would have been obvious to one of routine skill in the art at the time of the invention to utilize deposited films of oxide.

14. Regarding Claim 11, Nordstom et al. disclose that the first nitride layer is formed by LPCVD (page 8, [0105]) and that the second nitride layer is formed by LPCVD (page

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13, [0137]).

15. Regarding Claim 12, Nordstom et al. disclose that functional devices within the integrated circuit are formed with LPCVD nitride layers. It would be obvious that PECVD could also be used to form the first and second layers of nitride, since both techniques produce a layer by CVD. In addition, commercial machines (Applied Materials, Novellus) are readily available in the art for plasma enhanced deposition. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to form both nitride layers by PECVD.

16. Regarding Claim 13, Nordstom et al. disclose (Figure 25b) that a portion of the first nitride layer remains overlying the oxide (See area near interface of area 13) after RIE is applied.

17. Claims 14 – 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nordstom et al.

18. Regarding Claim 14, Nordstom et al. disclose a method for forming semiconductor devices in an integrated circuit with a plurality of device types in a substrate at the surface of the substrate having regions doped to a first conductivity type (page 21, claim 40). An oxide layer is grown over the substrate and subsequently patterned to expose pre-selected portions of the substrate (Figure 7). Ion implantation (second conductivity type) is done through a thin oxide that serves as stopping layer to define edge zones (Figure 8). A nitride layer is formed on the oxide and masked to define device areas (Figure 14) of the first and second conductivity type. A second layer of nitride is depos-

ited (page 13, [0137]) over the first nitride layer, further overlaying an exposed portion of the substrate and sidewalls of the opening Using RIE (page 13, [0140]) a portion of the second nitride layer is removed to expose the surface of the substrate without removing portions of the nitride covering the sidewalls (Figure 25b), wherein the oxide layer remains sealed by the first and second layers of nitride. Nordstrom et al. disclose the use of RIE for etching the nitride layer, but do not disclose the times required to perform the task of removing the nitride overlaying the surface of the substrate without removing portions of the nitride layer overlaying portions of the sidewalls. It would have been obvious to one of ordinary skill in the art at the time of the invention to adjust the times of etch to avoid removing all of the layer from sidewalls. Since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimal or working ranges involves only routine skill in the art *In re Aller*, 105 USPQ 233.

Nordstrom et al. do not use a nitride film as a stopping layer for ion implantation, but rather an oxide film. Thin oxide and nitride films are equivalent for ion implant stopping layers and have been used in the art since the early 1970's. Hence, based on equivalence and widely known use in the art, it would have been obvious to one of ordinary skill in the art at the time of the invention to use a nitride stopping layer for accelerating process flow. Further, a first nitride layer is deposited atop the oxide layer, subsequent to ion implantation, followed by formation of a second nitride layer, whereby the layer sequence is sealed.

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19. Regarding Claim 15, Nordstom et al. disclose (page 11, [0128]) that the contact openings through the nitride and oxide layers are done with a dry etch with one photo-resist mask (Figure 21b).

20. Regarding Claim 16, Nordstom et al. disclose that the first nitride layer is formed by LPCVD (page 8, [0105]) and that the second nitride layer is formed by LPCVD (page 13, [0137]).

21. Regarding Claim 17, Nordstom et al. disclose that functional devices within the integrated circuit are formed with LPCVD nitride layers. It would be obvious that PECVD could also be used to form the first and second layers of nitride, since both techniques produce a layer by CVD. In addition, commercial machines (Applied Materials, Novellus) are readily available for plasma enhanced deposition. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to form both nitride layers by PECVD.

22. Regarding Claim 18, Nordstom et al. disclose (Figure 25b) that a portion of the first nitride layer remains overlying the oxide after RIE is applied (See near left side interface of Area 13, under poly-Si).

Response to Arguments

23. Arguments of Applicant with regard to Claims have been carefully considered, but have not been found to be persuasive. With regard to Claim 1, the second nitride layer is clearly in contact with the first layer of nitride (34), as shown in Figure 25a, forming a

“sealing” layer, and as discussed in more detail in the rejection of the Office Action.

With regard to Claim 4, Applicant argues that after RIE Nordstrom et al. do not disclose that a portion of the first layer of nitride remains overlaying the oxide layer. This is clearly shown in Figure 25b, (near interface of Area 13), where the first nitride layer segment overlays the oxide layer.

With regard to Claim 7, a contact opening is formed by RIE without a mask (page 13 of Reference, par. [0140]) for a prescribed period of time to remove portions of the second nitride, while retaining portions of the nitride along the sidewalls of the opening (Figure 25b). the oxide layer (at the interface and adjacent to field region) is definitely sealed by the first and second nitrides as shown in Figure 25b.

While Applicant is correct in stating that the objectives of Nordstrom et al. differ from those recited in the instant application, it has been ruled by the court that there is no requirement that the prior art provide the same reason as Applicant to make the claimed invention. In re Linter, 458 F.2d 1013, 173 USPQ 560 (CCPA 1972), In re Dillon, 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1990), cert. Denied, 500 U.S. 904 (1991).

Claim 14 is disclosed by the reference. As mentioned, it is well known in the art that nitride and oxide have equivalent “stopping” capability for ions, based on cross sections (See for example, S. Wolf and R.N. Tauber, “Silicon Processing for the VLSI Era: Volume 1 – Process Technology,” Lattice Press, sunset Beach, CA (1986), pp. 321 – 324) and the physical effects

are similar. Thereafter, the reference discloses all of the limitations recited in the instant application.

Conclusions

24. THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to **Thomas Magee**, whose telephone number is **(703) 305 5396**. The Examiner can normally be reached on Monday through Friday from 8:30AM to 5:00PM (EST). If attempts to reach the Examiner by telephone are unsuccessful, the examiner's supervisor, **Tom Thomas**, can be reached on **(703) 308-2772**. The fax number for the organization where this application or proceeding is assigned is **(703) 308-7722**.

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Thomas Magee
June 18, 2003


TOM THOMAS
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800